

GOLDMANN ON THE AFTER COURSE OF SKIN-GRAFTS
TRANSPLANTED AFTER THE METHOD OF THIERSCH.¹

THESE researches into the process of repair in the method of grafting invented by Thiersch have been carried out at the surgical clinic of Professor Kraske in Freiburg, and throw much light upon the *rationale* of this process.

But a few years have passed since Thiersch published his new method for covering large defects of the soft parts by the transplantation of skin-grafts. Already the number of publications recommending and dealing with the method is very large. It only remains to work out the anatomico-physiology of the process, and this Goldmann has attempted. These researches are not only of theoretical value, but, by demonstrating to which sorts of defects the method is applicable and to which it is not applicable, they are of eminent clinical value as well.

Thiersch regarded the permanent covering of ulcer of the leg as a crucial test of the method. From many sources now comes the complaint that the method is not satisfactory in just this class of cases. Garré observed, by careful histological study, certain changes in the underlying tissues which were the cause of the failures in grafting upon ulcer of the leg.

On the other hand, Urban, in the most recent publication from Thiersch's clinic, states that a permanent covering with Thiersch grafts is especially attainable in ulcer of the leg when an appropriate after-treatment is carried out.

Another question which Goldmann would answer is that with regard to the time when these grafts can be applied to the best advantage. For example, a defect of the nose is repaired by a skin-flap from the forehead. Should the secondary defect be grafted immediately after the operation, and what are the changes occurring in this place after months or years? When skin-grafts have been applied, and healing has taken place without the formation of granu-

¹ Ueber das Schicksal der nach dem Verfahren von Thiersch verpflanzten Hautstückchen, Beiträge zur klinischen Chirurgie, XI Band, 1 Heft, p. 229.

lations, after the course of months the new skin is observed to be slightly reddened, at first covered with lamellated scales, and later rather slimy, level with the other skin, more or less movable upon its bed, and lastly endowed with normal tactile, and thermic sensibility. None of the signs of scar-shrinkage are present. These facts give rise to the following questions:

- (1) What is the cause of the peculiar scaling off of transplanted skin?
- (2) Within what time after the grafting are the above-mentioned conditions to be observed? Do they appear synchronously or at different times?
- (3) Upon what does the movability of the transplanted skin depend?
- (4) How is it that the transplanted skin becomes elevated to the same level with the surrounding surface?
- (5) How does the sensibility become restored?

When a skin-graft, which has been left uncovered, is observed, it is seen that the outer layer is cast off more rapidly than in the normal skin. Besides this, there is also an exfoliation of some of the deeper cells of the epidermis. There is also a vigorous cell-proliferation in the middle layer of the epidermis, which continues two or three months. After some months this scaling off ceases. This scaling is due to nutritive changes. It stops when the new system of vessels have formed beneath the skin which establishes a normal nutritive supply. This formation of new vessels immediately beneath the skin is the cause of the reddish tint which it assumes at this time, and which contrasts it from the surrounding skin.

Zander has shown that cutaneous cornification is dependent upon the nourishment of the particular area. The higher and more numerous the papillæ, or, in other words, the better the nourishment, just so much thicker will be the epithelial layer, and just so much less will be the shedding of the superficial cells. The poorer the nourishment, the thinner the skin. When grafts are first applied, the papillæ are very shallow and the skin very thin. Regeneration takes place from the deepest and middle layers.

In general, it may be said that the more abundant the blood-supply to the grafted area, the sooner will the new skin be elevated to the level of the surrounding skin surface. It not uncommonly occurs after grafting defects of the leg that a depression always exists. On the other hand, for example, after grafting the forehead, the excavation becomes obliterated in the course of four or six weeks.

The movability, too, of the new skin depends on the floor upon which it rests, the surrounding tissue, and, in part also, upon the size of the defect. In the case of small defects, the movability of the skin is observed in six or eight weeks. This may become so great in the course of months that the skin can be lifted up in folds.

The return of sensibility is the last to occur. In the case of large defects sensibility may never return, or it may be limited to the peripheral zone. Goldmann has observed in a large number of cases that the nervous function returned first to the periphery. Usually two or three months elapse before sensibility is fully restored.

The period elapsing before these physiological functions are restored is a very variable one, and influenced by a multitude of circumstances.

Before answering the question as to the movability of the skin, first must be answered, Upon what does this movability depend? Zenthoefers says that the elastic fibrous tissue has the function of holding the skin in its normal position, and returning it when moved. There is but little of this elastic tissue in such places where the skin is but slightly movable; whereas it is abundantly developed under skin which can easily be taken up in folds.

Goldmann has had an opportunity to make some sections through an area of skin grafted upon the upper part of the neck four months after the operation, and found that the skin was freely movable and abundantly supplied with elastic fibres. He was not able to decide when this developed or from what tissue it sprang. Garré has observed such fibres at the end of ten days. It is probable that these fibres grow up from the underlying tissue and from the periphery of the defect. No elastic fibres are found in the ordinary scar-tissue, so

that when a granulating area is left between two skin-grafts here is a point of fixation. The presence of inflammatory tissue seems to retard or prevent the development of elastic tissue. The tendency to contraction exhibited by granulation-tissue and its ultimate diminished blood-supply make it a poor ground for the implantation of skin-grafts, which do much better upon a fresh wound surface.

Garré has observed that the vessels in the transplanted skin degenerate, and new vessels grow up from beneath to the truncated papillæ. Goldmann's observations upon grafts three to five months after the transplantation showed vessels running along parallel to the surface at the border between the bed and the graft. These vessels were surrounded by small round cells. From these very fine branches passed up to the epidermis. Separated from the deepest layer of epithelial cells by a very thin transparent zone they curved, and, running along just beneath the epidermal epithelium, formed a rich anastomosis with the neighboring vessels. And everywhere were the appearances of cell-proliferation. Mitoses were observed in the endothelial cells within the capillaries, both at the ends of the capillaries beneath the epidermis and at their junction with the mother-vessels. The new vessels which form in the transplanted skin seem to be nothing more than capillaries, as the walls are made up chiefly of a layer of endothelial cells, and no muscularis is present. The capillaries constitute the "subpapillary net-work" of Spalteholz, through which the skin is nourished. This net-work is of great importance to the vitality of the newly-implanted skin, and the development of its vessels is not completed for several months.

With this development of new vessels is also a formation of elastic fibres and young connective tissue. Karg has made some observations in skin-grafts eight weeks old. In these he found that the transplanted skin was richly infiltrated with young connective-tissue cells. Numerous leucocytes were also observed, and newly-forming blood-vessels. The original cutaneous net-work had almost disappeared. There was also a vigorous cell-development in the epidermis.

The same observer discovered in grafts of twelve weeks' standing that the cutis was firmer and the cellular infiltration less, while the number of new connective-tissue cells in the normal skin was much increased.

Garré studied skin-grafts four to eighteen months old, and observed that the upper part of the preparation showed the normal loose connective tissue, in which the vessels passed to the summits of the papillæ. There was no cicatricial or dense tissue, as has been theoretically supposed. These observations correspond with those of Goldmann, who thus explains the absence of any tendency to cicatricial contraction in grafted skin.

Observation shows that sensibility returns to the grafted area usually from the periphery inward. Sometimes a return of sensibility is observed in small areas surrounded by an anaesthetic surface. A number of such sensitive islands would become larger and larger till finally by their confluence the whole surface became sensitive.

As a result of the observations which Goldmann has carried out, the chief conclusion of clinical value is that the positive healing of skin transplanted after the method of Thiersch is not accomplished fully till the end of a period involving several weeks or even months, and not until this time has elapsed is the newly-implanted skin fully resistant and as capable of withstanding trauma and disturbances of nourishment as the normal skin; and, moreover, that a better vitality is assured when the skin is planted upon the normal soft parts than when granulation or scar-tissue forms the bed upon which the grafting is done.

JAMES P. WARBASEE.

NASSE ON THE EXTIRPATION OF THE SHOULDER, AND ITS VALUE IN THE TREATMENT OF SAR- COMA OF THE HUMERUS.¹

THE amputation of the arm, together with the scapula and a portion of the clavicle, was first performed by Cuming in 1808. It was

¹ Dr. D. Nasse: Berlin, *Sammlung klinischer Vorträge*, No. 86.